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Report on Insect Control

Spring, 1933

July 8, 1933

Emil Ernst

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UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
YOSEMITE NATIONAL PARK
CALIFORNIA

OFFICE OF THE SUPERINTENDENT

July 10, 1933

C. G. Thomson, Superintendent
Yosemite National Park
California

Dear Col. Thomson:

There is transmitted herewith report of Insect Control Operations for the spring of 1933.

Respectfully yours,

Emil Ernst
Ranger-Forester

EJ

Copy (no pictures or maps) sent
FCC
Ansel Hall
Sequoia N.P.
Reg. Forester
FPK
JCE
Sierra N.F.

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Introduction

Yosemite National Park completed on the 31st of May the most extensive and also intensive insect control program ever attempted in the history of the Park. Although this insect control program was the largest attempted and completed up to the present, the Park does not intend to stop at this point. The control project carried out this spring used funds regularly appropriated for such work, and the funds so provided have been expended at the time when they would do the most good. Spring control work has always been considered the most effective in reducing the insect population in the woods, and it was with this thought that the Park expended practically all of the $26,000 allotted from the 1933-34 fiscal year funds with an additional balance of $3,900 left over from funds provided for the same purpose in the fiscal year 1932-33. Approximately $1,200 was remaining from these combined appropriations on the 1st of June, and will be used for further insect control work during the balance of the year.

Areas Involved

The insect control work was carried on in a belt averaging three miles in width which extended from the Mariposa Grove of Big Trees to the Middle Fork of the Tuolumne River, an airline distance of 30 miles. This belt of approximately 60,000 acres contains the largest blocks of some of the finest Sugar Pine timber in the possession of the Government. Elevations in this belt run from 3,500 to 7,500 feet above sea level and include the altitudinal ranges of the Ponderosa and Sugar Pine stands in the Park. The timber types start with the Woodland-grass type where a few scattered Ponderosa Pine were encountered through the Ponderosa Pine, Sugar Pine, Douglas Fir, true Firs, and Jeffrey Pine in their varying timber types. Yosemite National Park is known for many things, and not the least are the magnificent stands of timber untouched by any logger's axe. Here Sugar Pine trees are often seen having diameters of ten feet and heights over 200 feet. The Ponderosa Pine also attain large size; one in mind being 98 inches in diameter and over 175 feet in height. Incidentally, this fine Ponderosa Pine known to many thousands of people was recently killed by insects of the genus Dendroctonus.

This belt of 90 square miles forms itself into six distinct entomological units, each of which has problems peculiar to itself. These entomological units were named from the most prominent feature therein, and are:

1. Yosemite Valley.
2. The Wawona Basin.
3. The Wawona Road.
4. Big Meadows, including a sub-unit, the Big Oak Flat Road.
5. Crane Flat, including a sub-unit, the South Fork of the Tuolumne River.
6. Ackerson Meadows.

This whole belt of 60,000 acres was given some inspection to determine the necessity of control work taking place, and treating actually occurred on 48,909 acres of this land. Included in this area treated were 1,225 acres of private lands within the Park boundaries that were naturally a part of the infestation units needing treatment. On account of the existing economic situation, the Park undertook to carry out the control work without leaving any foci of reinfestation within the treated areas of the Park. It was considered cheaper in the long run to eliminate any such danger of reinfestation, even though the costs accrued on lands not belonging to the Government./ The private lands and their owners enumerated below are situated in the Wawona Basin and Big Meadows:

		Acres
Township 4 South, Range 21 East,	Section 35, many small owners	660
Township 3 South, Range 20 East,	Sections 2 and 3, Mrs. Elizabeth Meyer	365
Township 3 South, Range 20 East,	Sections 2 and 3, many small owners	200
	Total	1,225

Of the 48,909 acres, 2,570 acres with a heavy infestation were treated for the Sierra National Forest through a cooperative agreement whereby the personnel of the Park insect control organization would do the work and the Forest Service would be billed through the usual channels. A double purpose was attained here in that the entomological units in the Wawona Basin and along the Wawona Road would be rounded out by the Park Service and the Forest Service could concentrate on its insect infestation problems far to the south of these areas./ The lands so treated are enumerated below:

Forest Service lands in the Rush Creek area:

	Acres
Township 4 South, Range 20 East, Section 25	640
Township 4 South, Range 20 East, Section 26	40
Township 4 South, Range 20 East, Section 36	280
Township 4 South, Range 21 East, Section 32	600
Township 5 South, Range 21 East, Section 4	210
	1,770

Forest Service lands in the Bishop Creek area:

	Acres
Township 4 South, Range 21 East, Section 5	160
Township 4 South, Range 21 East, Section 7	320
Township 4 South, Range 21 East, Section 8	320
	800
Total of all Forest Service lands treated	2,570

The legal descriptions of the lands involved in the control program are listed as follows. The areas have been separated according to the crew that did the control work, and in some cases it will be seen that some sections have been partially worked by two and possibly three crews, a condition dictated by topographical and weather factors.

Treated by the "A" in the Wawona Basin

	Acres
Township 4 South, Range 21 East, Section 22	160
23	320
25	240
26	360
27	640
29	360
32	40
33	340
34	400
35	660
Township 4 South, Range 21 East, Section 36	640
Township 4 South, Range 22 East, Section 31	640
32	320
Township 5 South, Range 21 East, Section 1	791
2	440
3	320
4	120
12	360
13	120
Township 5 South, Range 22 East, greater portion of Big Tree Grant	3,000
19 Sections	10,271
Forest Service lands, Rush Creek 5 Sections	1,770
24 Sections	12,041

Treated by the "B" from Camp A. E. Wood

		Acres
Township 3 South, Range 20 East, Section	12	300
	13	400
	20	640
	21	500
	24	340
	25	120
	32	260
Township 3 South, Range 21 East, Section	8	480
	17	440
	20	640
	29	560
	32	320
	33	320
Township 4 South, Range 20 East, Section	1	40
Township 4 South, Range 21 East, Section	5	635
	8	598
	9	160
	16	240
	17	600
	20	480
	21	640
	22	320
	27	80
	28	640
	29	280
	33	300
	34	240
Township 4 South, Range 22 East, Section	32	100
	28 Sections	10,673

Treated by the "C" at Big Meadows

		Acres
Township 2 South, Range 20 East, Section	25	200
	26	260
	27	380
	28	600
	32	80
	33	480
	34	640
	35	640
Township 3 South, Range 20 East, Section	2	480
	3	645
	4	300
	10	260
	11	160
	13 Sections	5,125

Treated by the "D" at Ackerson Meadows

		Acres
Township 1 South, Range 20 East, Section	7	600
	8	140
	16	40
	17	560
	18	646
	19	645
	20	640
	21	80
	30	240
	9 Sections	3,591

Treated by the "F" at Aspen Valley

		Acres
Township 1 South, Range 20 East, Section	28	280
	29	640
	31	160
	32	927
	33	938
	34	954
	35	320
Township 2 South, Range 20 East, Section	3	80
	4	160
	5	240
	6	80
	11 Sections	4,779

Treated by the "F" at Wawona Dome

		Acres
Township 4 South, Range 21 East, Section	23	160
	24	640
	25	160
	26	160
Township 4 South, Range 22 East, Section	18	80
	19	640
	29	160
	30	640
	8 Sections	2,640

Treated by the "GC" on the Big Oak Flat Road

		Acres
Township 2 South, Range 20 East, Section	24	480
	25	160
Township 2 South, Range 21 East, Section	19	160
	30	640

		Acres
Township 2 South, Range 21 East, Section	31	160
Portion of the Yosemite Grant, Section	1	640
	6 Sections	2,240

Treated by the "GC" on the Wawona Road

		Acres
Township 2 South, Range 20 East, Section	36	280
Township 2 South, Range 21 East, Section	31	640
Portion of the Yosemite Grant, Section		480
Township 3 South, Range 20 East, Section	1	360
	12	200
Township 3 South, Range 21 East, Section	5	640
	8	200
	9	40
	8 Sections	2,840

Treated by the "H" at Crane Flat

		Acres
Township 2 South, Range 20 East, Section	5	420
	6	260
	7	480
	8	160
	17	320
	18	160
	20	480
	7 Sections	2,280

Treated by the "YV" in Yosemite Valley

	Acres
Portion of the Yosemite Grant	2,700

GRAND TOTAL - - - - - Portions of 109 Sections	48,909

Values at Stake

With the exception of the 1,225 acres in private lands, all of the areas treated were Government land, either under the jurisdiction of the Park Service or the Forest Service. Unlike the case in the Forest Service, the National Park Service in Yosemite does not have stand figures available for all of its lands, and an approximation from the few cruises existing on the Park lands will have to suffice as a basis for estimating the amount of timber threatened by the insect infestation. It can safely be said, however, that at

least two billion board feet of some of the most scenic and finest timber in the world was given protection from an infestation that was gaining in intensity. The Park has not been in the habit of considering values on the board foot basis, a position tenable under the circumstances. It is practically impossible to assign any monetary value to the timber threatened by the insects. However, an indication of the high value can be gained from the recent purchase by the Park of the Rockefeller Purchase Lands, some 12,000 acres, at a cost of over $3,000,000. The areas involved in this control, although not up to the stand average of the Rockefeller Purchase Lands, come to five times this size, or 60,000 acres. All of these 12,000 acres of the Rockefeller Purchase came into the control program.

The Ponderosa and Sugar Pine stands of the Park are famous for the amount and quality of the timber growing in them. Sugar Pine trees 80 or more inches in diameter and over 200 feet in height are not at all uncommon. These forests represent the climax types for the regions in which they exist, and are some of the finest examples of their kind. Accepted cruises of the lands now within the Park show sixteenth sections very commonly having over two million board feet of timber, and a few such 40-acre areas are found with four million board feet of timber. This is particularly true in the lands in the Ackerson Meadows and Crane Flat units, and the Mariposa Grove of Big Trees has some areas closely approaching these figures. An average of 1,400,000 board feet per 40 acres would not be far off for the entire area in the spring control program.

Insects Responsible

The main part of the spring control operations was directed toward the reduction of the Western Pine Bark Beetle (Dendroctonus brevicomis Lec.) and Mountain Pine Bark Beetle (D. monticolae Hopk.) population in the Ponderosa Pine and Sugar Pine, respectively. These insects have been responsible for the bulk of the damage in the Pine types of the Park for a period of several years, and have been gaining fast in intensity of attack. Practically all of the insects of a primary nature having their habitat in the Park have shown decided increases, and include the following:

Host	Insect Responsible for Damage
Ponderosa Pine	1. Western Pine Beetle (Dendroctonus brevicomis)
	2. Mountain Pine Beetle (D. monticolae)
	3. Engraver Beetles (Ips spp.)
	4. Flatheaded Borers (Melanophila gentilis)
	5. Red Turpentine Beetle (D. valens)

Host	Insect Responsible for Damage
Sugar Pine	1. Mountain Pine Beetle 2. Engraver Beetles 3. Flatheaded Borers 4. Red Turpentine Beetle
Jeffrey Pine	1. Jeffrey Pine Beetle (D. jeffreyi) 2. Engraver Beetles 3. Flatheaded Borers

The campaign being directed only toward the reduction of the above insect population, it must not be taken for granted that these insects and their damage are the only problems confronting the Park. A Flatheaded Borer (Melanophila drummondi) is causing large losses in the Douglas Fir on the slopes around Yosemite Valley, a scolytid (Scolytus subscaber) is causing heavy losses in the White Fir, and still another Flatheaded Borer is destroying large numbers of Incense Cedar, a fact especially evident in the Wawona Basin and to some extent, also, in the Yosemite Valley.

As stated before, the campaign was directed against the members of the genus Dendroctonus in particular, but whenever possible the other primary insects were destroyed in treating the Dendroctonus infested trees.

Propagation of Predators

Predators on the insects causing the losses in the Pine forests of the Park were given every encouragement for multiplication. The Red Bellied Clerid (Enoclerus sphegeus), a decided enemy of the Mountain Pine Beetle, was common on infested trees and undoubtedly helped considerably in reducing the numbers of the Mountain Pine Beetles present in the woods. The Blue Green Trogositid (Temnochila virescens) was very common, and probably some of these predators could be found on every tree treated. Instructions were given to the treaters to favor these predators as much as possible. Care was taken to throw the tree away from the stump whenever conditions allowed this to be done, so that the fire could be kept away from the stump where these predators pupate close to the ground. For the Blue Green Trogositids all the abandoned bark was left unburned so that they, too, could multiply.

Character and Intensity of the Infestation

Indications that the infestation by the Western Pine Beetle of the Ponderosa Pine is not maintaining its rate of increase are evident to some extent, but not enough to say conclusively that this is actually taking place. However, it can be stated that the Mountain

Pine Beetle is increasing its rate of attack on the Sugar Pine many fold. It appears that the bulk of the insect control work in the near future will be centered in the attacks taking place in the Sugar Pine stands. The attacks of the Mountain Pine Beetle are showing up in larger numbers in the Ponderosa Pine; this, in itself, is believed to be an indication of an enlarging infestation. This phase of the Mountain Pine Beetle attack was common on the poorer sites for the Ponderosa Pine in such areas as the slopes around Yosemite Valley and other poor sites near Aspen Valley Ranger Station, as well as the higher slopes around the Wawona Basin. The attacks of this beetle indicate a repetition of an epidemic similar to the one by the same beetle in the Lodgepole Pine that has as a grim reminder the "Ghost Forests" in the Tenaya Lake and Tuolumne Meadows regions of the Park. The attack of this beetle is taking out bigger trees, more trees, larger groups, and an increasing number of groups, and it is nothing uncommon to see groups of very large Sugar Pine trees have five or six dead individuals killed by this beetle in the last two years. The situation is far more advanced in this serious aspect of group attacks on the private timber holdings to the west of the Park, particularly on Crocker Ridge and Pilot Peak within the Stanislaus National Forest boundary. Another feature of the Mountain Pine Beetle attack was the large number of strip-killed Sugar Pine, adding to the spotting difficulties.

An increasing number of Flatheaded Borer attacks are noticeable on the poorer sites in the Sugar, Ponderosa, and Jeffrey Pines. Trees killed by Flatheaded Borers were observed and treated on the slopes around the Wawona Basin, Yosemite Valley, and Ackerson Meadows. The presence of these insects was quite common on trees treated primarily for other insects.

An increase is noticeable in top-killing of small trees by Engraver Beetles. Quite a few young Ponderosa Pine in good sites have been killed back by what appears to be Engraver Beetles in Yosemite Valley this spring. In very many cases, only the leaders have been killed, a fact that will develop multiple-topped trees if the attacks do not further progress in these trees. The Engraver Beetles have been reported as being common in the trees treated for other primary insects, and have also been destroyed along with them whenever found.

Since the close of the spring control operations, a strong flight of Red Turpentine Beetles has been reported by rangers from the Mariposa Grove of Big Trees. The presence of this beetle was very common in trees attacked by other bark beetles. These beetles have helped to weaken considerably the Giant Yellow (Ponderosa) Pine in Yosemite Valley known to thousands of people.

History of the Present Control Program

The infestation now existing has been developing for several years and was first recognized as unusual in the fall of 1930, when a noticeable pick-up in the amount of losses occurred in the Wawona Basin, along the Wawona Road, and in the Big Meadows region. Little attention was paid to the possibility that this infestation would develop into the situation now in the Park, although a small scale control project was carried on along the Wawona Road, Yosemite Valley, the Big Oak Flat Road, and Big Meadows in the spring of 1931. A cooperative control was carried on at the same time by the Forest Service on adjoining lands along the Wawona Road. An appropriation of $3,100 provided the funds for this work, which sum was completely expended on this spring project. At the time this control project was too extensive to obtain anything more than a temporary setback to the infestation on the areas where the project was carried out.

The estimates of October, 1931, showed that the infestation by the Western Pine Beetle in the Ponderosa Pine was increasing at a fast rate. Even with this evident fact, a much smaller appropriation of $1,700 came in April of 1932 too late to accomplish much good where it was expended along the same areas covered in the previous spring's control project.

An appropriation of $5,100, adequate enough to initiate a control project in the Sugar Pine in the Mariposa Grove of Big Trees, became available at the end of April, 1932, and work in the Grove began on May 12 and finished there on June 9. Some additional clean-up work took place in Yosemite Valley. Seven days were spent on the additional work in Yosemite Valley on Ponderosa Pine attacked early in the spring of 1932. Some heavy broods were destroyed in these trees.

A considerable sum remained over from the operations in the Mariposa Grove of Big Trees, which financed an intermittent control carried on in Yosemite Valley during the entire summer of 1932. One set of fallers was kept at work treating at irregular intervals the Ponderosa Pine as they became infested. Control costs in Yosemite Valley can not be compared with costs for other areas because of the many precautions necessary in such an intensively used area. Treating was done by the pit burning method, which involved the transportation of the peeled bark to a pit specially constructed for the purpose at each tree. This control work terminated in October, and accounted for the treatment of 106 trees on the Valley Floor. The good feature of control work in Yosemite Valley is the immediate utilization of the wood for various domestic purposes. Without doubt, this intermittent control kept down an incipient serious situation in the Valley.

The Insect Investigation Survey of 1932 has been the greatest factor in developing the present well-organized insect control organization in Yosemite National Park. This survey was undertaken because it was becoming more evident every day to the Park Superintendent that an infestation of serious proportions was developing in the Pine stands of the Park, and before concrete proposals could be made for control work an inventory of the damage being done was necessary. With the extremely helpful technical advice of Mr. John M. Miller, Senior Entomologist of the Bureau of Entomology, this much needed survey was conducted by Ranger Emil Ernst and Temporary Ranger David Tucker, assigned from the Ranger Department. Both of these men are trained foresters with some experience in insect infestation work. In the plans proposed for this survey, two facts were to be determined: (1) the extent of the losses for the season of 1931; and (2) the extent of the losses for the season of 1932; and from these data were to be proposed the plans for the future conduct of the campaign against the bark beetles. These two men carried on the survey throughout the summer, setting up a series of sample plots scattered strategically throughout the Ponderosa and Sugar Pine stands of the Park. The greater part of the survey was carried out in these two types. However, the Jeffrey and Lodgepole Pine types were not forgotten. In these minor types, sample strips and trail and road counts gave an indication of the conditions existing.

Wherever possible, permanent sample plots, usually 320 acres in size, were laid out so that future surveys could give quickly an indication of the infestation trend at the time of the surveys. Two of these plots have been permanently tagged, and others will so be tagged this coming season. The permanent sample plots were supplemented by sample strips five or ten chains in width and 80 chains in length. These sample strips were used where conditions or time did not allow the setting up of the larger sample plots. Road and trail counts were also a part of this survey and took in a strip five chains in width on either one of the sides of the trail or road. To give a more extensive idea of the infestation present, practically the whole area involved in this spring's control work was covered by a system of topographic viewing from points of vantage selected as carefully as possible. Due to the topography existing in the Park, this system will eventually become an important adjunct to the insect infestation detection organization of the Park. It can be used for all of the timber types in a relatively short time, but has its greatest value in conjunction with the sample plots and sample strips. Paragraph A

From the data obtained in this survey, recommendations were made calling for the expenditure of $30,500 in the season of 1933 on insect control work. Approximately $4,000 remained unexpended in the $5,100 allotted at the end of April, and the balance necessary

was placed at $26,500. In November, unappropriated Forest Protection funds amounting to $3,000 were placed at the disposal of Yosemite National Park. With this balance of $7,000, a winter insect control project was launched with the first favorable weather in the first week of December in the Mariposa Grove of Big Trees. This project was carried on in wintry conditions for a period of 22 days until the 23d of December. It was this project that placed the Park in a very favorable position as to personnel when the spring insect control program was launched in late February of 1933. The experience gained in this control helped considerably in the planning and execution of the later work.

At the end of February, steps were taken for the expenditure of the balance of $3,900 in the insect control funds in the Wawona Basin, along the Wawona Road, Big Meadows, and Yosemite Valley, and while the work was gaining headway an appropriation of $26,000 became available, making a balance of $29,900 for insect control work in the Park. Immediately the plans proposed the previous autumn were put into effect.

Cooperative Activities

The general program came under the advisory supervision of Mr. John M. Miller of the Bureau of Entomology. He spent a great deal of time planning the campaign and checking the work in the field, and many valuable suggestions offered by Mr. Miller were carried out to the profit of the Park. The Bureau obtained essential cooperation from the Park in its spring survey on Regional Plot #14, permanently located near the Aspen Valley Ranger Station. There were treated under the supervision of and for the Bureau of Entomology 36 Ponderosa and Sugar Pine, with an estimated 108,600 board feet of timber. The infested trees in this plot being on Park land, the treating work was performed by axemen selected from the insect control camp at Aspen Valley Ranger Station. The Bureau was notified in ample time to do the preliminary investigating before treating was started by the Park. Copies of the most important data were obtained immediately for the Park..

Cooperation on a more extensive scale was obtained from the Park by the Sierra National Forest on its lands in the Bishop Creek area in the Wawona Road unit and the Rush Creek area in the Wawona Basin unit. The Sierra National Forest had an extensive insect control program on the forest far to the south of these two localities which needed the undivided attention of the forest personnel. It was essential that these two areas be included in this spring's insect control work because they formed a part of two entomological units and would offset considerably the work in the rest of these units were they left untreated. Accordingly, an arrangement was made whereby the Park carried out the treating program with its

personnel and equipment, the costs of which were to be paid by the Forest Service. This work came under the direct supervision of the Bureau of Entomology, which was the field representative of the Forest Service on these areas.

Summary of Work Performed

	Acres	Trees	Volume	Total Costs	Cost per Tree	Cost per M.
Bishop		P.P. 59	96,660			
Creek Area	800	S.P. 2	1,290	$ 259.40	$ 4.25	$2.64
Rush		P.P. 128	348,990			
Creek Area	1,770	S.P. 111	714,120	$1,822.12	$13.10	$1.71
		P.P. 187	445,650			
		S.P. 113	715,410			
Totals	2,570	300	1,161,060	$2,081.52	$ 6.93	$1.79

With the exception of the recently fire-damaged areas in the Park, the Forest Service lands in the Rush Creek area were more heavily infested on the average than the lands within the Park. The Forest Service sustained heavier losses in its Sugar Pine than in its Ponderosa Pine. The areas immediately adjacent to Rush Creek and in its basin sustained the heaviest loss.

Cooperation from the other departments of the Park was decidedly of the best character. This cooperation involved the opening of roads, telephone communication, sanitation, plumbing, mess operations, and trucking. The recruiting of the labor was a considerable amount of work. The segregation of these many details from the field work helped to smooth out the operations against the bark beetles. The vast amount of land involved and the manner in which control work is done compel the concentration of efforts on the job itself. Anything that detracts attention from the woods work tends toward inefficiency and laxness in control. It is highly desirable from the insect control viewpoint that the set-up now existing be maintained in future control work.

Organization of Control Work

A condition somewhat unusual for insect control organizations existed on this control program. Responsibility for the whole program rested with the Ranger-Forester for the Park, and he was primarily concerned in the field with the technical side of the program, such as spotting, accounts, and checking of the treating done. The responsibility for the treating rested in the main, however, on the shoulders of the general foreman who had charge of the operations in the woods. A definite division existed between the spotting organization and the treating organization, although working side by

side practically all of the time. The only contributed time on the whole program was that of the Ranger-Forester assigned to the program from the Ranger Department.

On account of the conditions existing and the size of the control program, efforts were made to standardize as much as possible the camp organization. The Park organization is so arranged that the mess operations are a separate part of every project undertaken in the Park, and this report will not deal with this necessary phase of every job. With the mess operations outside of their scope of operations, the camp foremen were free to pay all their attention to the work in the woods. These standardized camps were usually composed as follows:

Treating		Spotting	
Foreman	1	Head Spotter	1
Axemen	24	Spotters	2
Truckdrivers	2	Compassman	1
Fireguard	1		
	28		4

The usual insect control camp had 32 men in the woods with an additional two men in camp, bull cook and saw filer. In one instance, one bull cook took care of the interests of two camps located at the same place practically throughout the entire program. The services of the saw filers were scheduled for two camps of 32 men at the same time. They alternated between the assigned camps as they were needed. The Park was lucky to obtain two very good saw filers, which accounts partially for the high daily production rate in the woods.

The spotting crew was separate from and still a part of the camp. They worked independently of the treating crews, marking the trees, keeping the records and time, and checking over the work of the treaters. It was the work of the spotting crew to see that the treating progressed in an orderly manner and that a check was kept so that no trees were missed that had been spotted. This check was kept by means of the standard tree tags and the master map in the field office. With exception of the rush at the beginning of the control program, the spotting organization functioned extremely well.

The position of the foreman is the outstanding feature of the insect control work in Yosemite National Park. With the elimination of the cares of the mess operations, he is free to devote all of his time to directing the treaters in the woods. He, of course, keeps the time, but outside of that there is no additional work loaded onto him. In the woods it was the duty of the foreman to

move the men from tree to tree according to the maps showing their location. In this he was able to oversee the work as it was done and correct immediately any mistake.

The treating crews in Yosemite are composed of three men, all called axemen. One is usually accepted as head, but he does not receive any additional pay. All of the axemen do the falling, limbing, peeling, preparation of the fire trenches, and the burning. There is no distinction between any of them, as is the case when certain men are designated as fallers, peelers, or laborers. It is believed that the axeman system of treating insures a smoother and more certain job of treating the infested trees. It was the custom that when a tree was all ready for burning two of the axemen would go ahead to the next tree and start to fall it while the third axeman stayed behind until the fire on the treated tree had about died down. This third man then came up to the other two to help them.

A maximum of 120 men were employed at one time in the insect control program. The number of men employed had been running for some time around 100 when a spell of hot weather speeded up the brood development and made fire conditions dangerous. An increase in the number of men employed took place to catch as many of the insects as possible before emergence began in great numbers. It was at this time that six men were employed as fireguards because of the hot spell and the large territory over which the treating was taking place. After a period of two weeks this high fire hazard disappeared, but the number of treaters was maintained so as to get the job over as soon as possible in order not to extend into the hotter weather later on.

On account of the changeability of insect control operations, it is impossible to set up a standard organization capable of taking care of all situations. Weather, transportation, accessibility, and a host of other factors change things every day. The 32-man organization developed for insect control purposes comes nearest to satisfying the conditions as they exist in Yosemite National Park. Any increase more than 10 per cent over this number makes the organization top-heavy and inefficient, while less than 25 men does not get the full benefit of the overhead present.

The mess set-up is radically different from the practice outside of Yosemite National Park. All mess operations in the Park come under a central organization which provides the cook, flunkies, utensils, and supplies. The rate for meals which the men pay is set in advance by the Park. This rate was placed at $1.05 per day and was taken out of the pay checks at the end of the month or upon leaving the job. Any profit or loss stayed in the general mess operations fund and was not plowed back into the insect control operations, a practice which is common on insect control projects outside of the Park.

The Camps

The center of operations in the Wawona Basin and along the Wawona Road was at the camp near Wawona called Camp A. E. Wood. This was an ideal location for working both of these important units. One camp of 32 men was stationed here throughout the entire span of operations from the end of February to the 20th of May, while another camp was also stationed here from the 8th of March to the 15th of April. For a period of six weeks, 64 men were stationed at this camp. Camp A. E. Wood was also the base for supplying the spike camp on Chilmualna Creek near Wawona Dome at an elevation of 7,000 feet.

A camp of 32 men was located at Big Meadows from the 6th of March to the 4th of April, treating in the Big Meadows unit. Upon the completion of the Big Meadows unit, this camp was in Yosemite Valley working the Wawona Road from the tunnel to Crouse Creek until the camp at Ackerson Meadows was ready for occupancy. This camp treated the Ackerson Meadows unit from the 10th of April until the 9th of May, when it was disbanded at the completion of the work.

The camp of 32 men stationed at Camp A. E. Wood until the 15th of April started treating in the Aspen Valley-South Fork portion of the Crane Flat unit on the 17th of April, making its camp at the Aspen Valley Ranger Station until May 13, when it was moved again to Crane Flat to work the Sugar Pine in the higher elevations around Crane Flat. This unit was working until the 19th, when 19 trees had to be left standing on account of an impending shortage of funds.

A treating crew of eight men was kept busy from the 4th of March until the 4th of April on the slopes of the Big Oak Flat Road above and below Gentry Ranger Station and also in the forks of Cascade Creek. This small crew was merged with the camp from Big Meadows on the 5th of April on the Wawona Road.

A spike camp of ten men was located on Chilmualna Creek close to Wawona Dome from the 15th of April to the 9th of May. This camp did a large amount of treating in the Sugar and Jeffrey Pine on Wawona Dome and along Turner Ridge. The trees that had to be abandoned for the time being by the main camp stationed at Camp A. E. Wood on account of snowstorms were picked up by this spike camp when conditions were more favorable.

To wind up the spring control operations, one set of fallers treated 40 trees found in Yosemite Valley between the 17th and 31st of May. This crew stayed at the main labor camp in Yosemite Valley.

Dates of Opening and Closing Work

Initial treating in the spring insect control program started on the 1st of March in the Wawona Basin unit, two days behind the spotters. The spotters had a hard job to get ahead of the treaters on account of the scattered infestation and the amount of snow on the ground. The spotters had to use snow shoes for a long time. Camps were transferred so irregularly that the following table will give the best idea of the coordination that had to be arranged so that no time was lost in the transfers. The transfer of the crews from unit to unit as the units were treated was one of the outstanding features of this control program, considering the indefiniteness that did and will always exist in an insect control project of any size. Such factors as weather, roads, accessibility, available transportation, the intensity of the infestation, the condition of the brood, and the selection of suitable camp grounds are never the same in any two seasons or times and have to be solved at the time. Without exception, the transfer of the crews occurred without any loss of time in labor and practically at the right time for each unit, although it was nip and tuck for a while in the Ackerson Meadows unit because of the long haul through Coulterville to the camp site at Ackerson Meadows.

Treating in the spring insect control program came to an end on the 31st of May in Yosemite Valley.

Tabulated List of Opening and Closing Dates in each Unit

Camp	Crew	Unit	Opening Date	Closing Date	Acres Treated
A. E. Wood	A	Wawona Basin	Mar 1	Apr 3)	
A. E. Wood	A	Wawona Basin	Apr 27	May 20)	10,271
A. E. Wood	A	Forest Service Lands	Apr 4	Apr 21	1,770
A. E. Wood	B	Wawona Road	Mar 8	Apr 15	10,673
Big Meadows	C	Big Meadows	Mar 6	Apr 4	5,125
Yosemite Valley	CC	Big Oak Flat Road	Mar 4	Apr 4	2,240
Yosemite Valley	CC	Wawona Road	Apr 5	Apr 8	2,840
Ackerson Meadows	D	Ackerson Meadows	Apr 10	May 9	3,591
Aspen Valley	E	Ack. Mds.-South Fork	Apr 17	May 13	4,779
Wawona Dome	F	Wawona Dome	Apr 15	May 9	2,640
Crane Flat	H	Crane Flat	May 13	May 20	2,280
Yosemite Valley	YV	Yosemite Valley	May 17	May 31	2,700
Total					48,909

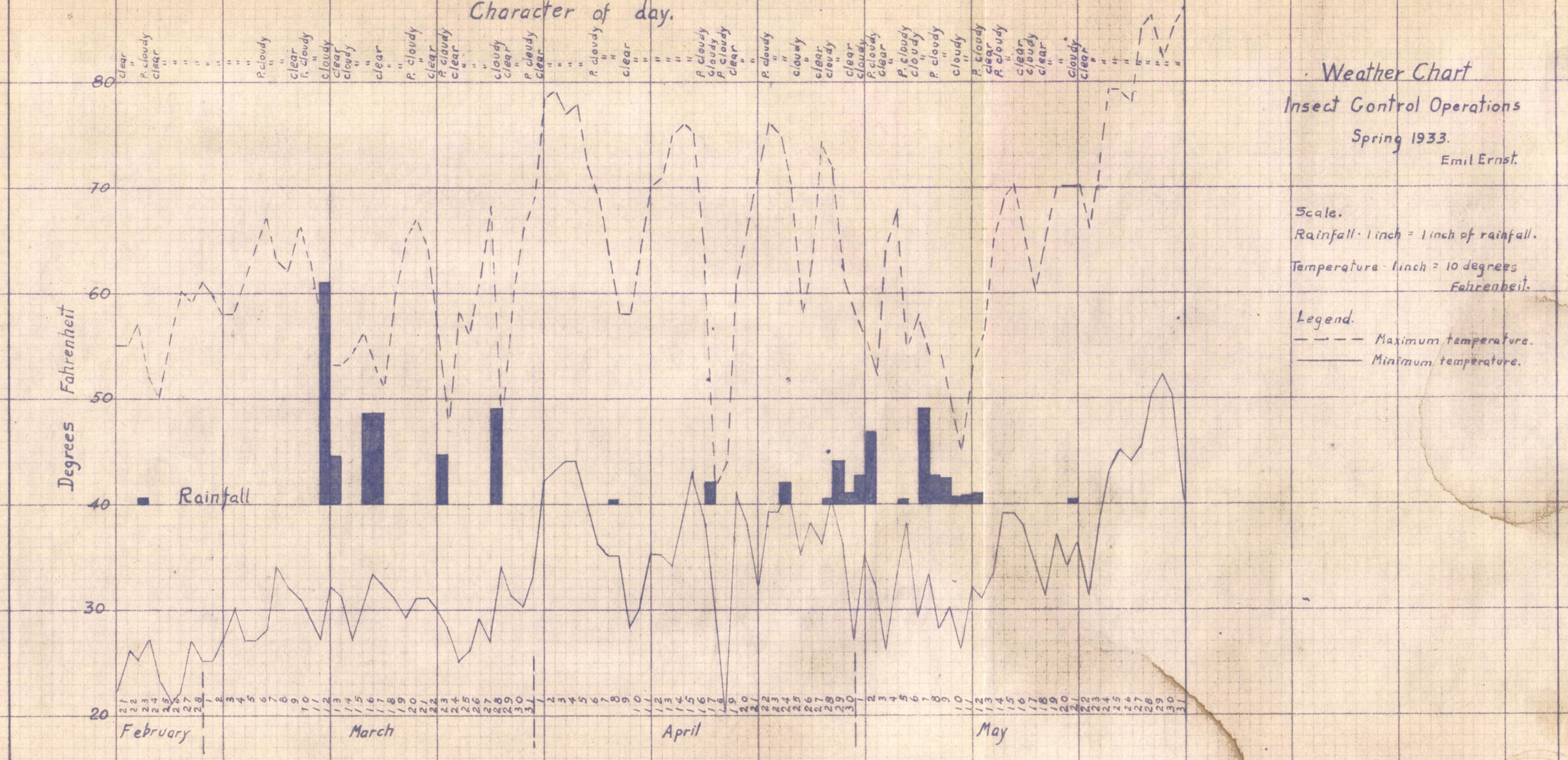
Climatic Conditions

Weather conditions were with one exception very favorable for insect control work. This exception was a period of 20 days when

some moderately high temperatures occurred with clear skies. Only one small storm occurred that helped somewhat to break what was tending to become a dangerous situation. The only fire of any size occurred during this dry period. The accompanying weather chart is from the records in Yosemite Valley, which is not entirely indicative of the weather on the treating areas where snow fell nearly every evening for almost a month, particularly in the Wawona Basin and on Wawona Dome. Weather conditions did not cause any great loss of time except for one day, the 12th of March, when 2.10 inches of rain were recorded in Yosemite Valley. All the rest of the precipitation was mainly in the form of snow at the areas being treated at the time, and helped rather than hindered the treating. Precipitation on the lower slopes was in the form of rain where treating was done early in the program, and this rain undoubtedly put out some of the fires remaining behind. In the 90 days in which the spring insect control program was carried out, a total of 9.05 inches of rain was recorded; an amount large enough to help the control program a great deal.

Rainfall

February	23	.04 inches	.04 inches
March	12	2.10	
	13	.45	
	16	.85	
	17	.85	
	23	.45	
	28	.90	5.60
April	8	.02	
	17	.19	
	24	.20	
	28	.03	
	29	.40	
	30	.09	.93
May	1	.26	
	2	.64	
	5	.01	
	7	.88	
	8	.25	
	9	.21	
	10	.05	
	11	.07	
	12	.08	
	21	.03	2.48
		Total	9.05 inches



Weather Chart

Insect Control Operations

Spring 1933.

Emil Ernst.

Scale.

Rainfall · 1 inch = 1 inch of rainfall.

Temperature · 1 inch = 10 degrees Fahrenheit.

Legend.

– – – – Maximum temperature.

——— Minimum temperature.

Wages Paid

The wages paid were the scheduled wages of the Park set up in Washington. They are listed as follows:

General Foreman	$7.00 per day	Head Spotter	$5.00 per day
Camp Foreman	6.00 per day	Spotter	4.50 per day
Sub-Foreman	5.00 per day	Compassman	4.75 per day
Sub-Foreman	4.75 per day		
Truckdrivers	5.00 per day		
Axeman	4.50 per day		
Laborer	4.00 per day		
Bull Cook	3.50 per day		
Saw Filer	5.00 per day		
Lookout-Fireman	4.50 per day		

Other specialized men on the Civil Service list of the permanent employees of the Park were called in for work, such as plumbing, sanitation, and road opening. Their salaries are not listed, as they varied considerably, due in the main to the length of time in the Service and the nature of their appointments.

It will be noted that the wages are comparatively high, but they are the wages standardized in the Washington Office for work of the type in the Parks. The class of men obtained and the working conditions, however, justified the payment of these high wages. The results in unit cost are low even at these high rates of wages.

Methods of Spotting

Two methods of spotting were used: the first, the strip cruising method; and the second, the contour cruising method. The contour cruising method was used only in country where the topography prohibited the use of the strip cruising method. To obtain the maximum of efficiency, four-man spotting parties were used: the head spotter, two spotters, and the compassman. The four-man parties were decided upon after it was found that three-man parties could not adequately cover the ground. Contour cruising was done by two-man parties.

Instructions were given to use reasonable judgment in the selection of the brood trees to be treated and not to pass anything by that had a brood in it. Spotting in Yosemite Park in the spring depends upon color alone for practically 50 per cent of the trees spotted, particularly in the Sugar Pine, where some phase of fading is in most cases the only indication of attack. In less than five per cent of the trees treated were the spotters on the poor side of selection, which, when one considers the conditions, is a very low percentage. Green trees in the Ponderosa Pine did not run over two

per cent by number, and these green trees were usually detected through some unnatural condition observed and not by sampling of the trees. In the Ponderosa Pine very few green trees were discovered by more sampling of the bark. It is estimated that 20 per cent of the Sugar Pine treated, however, was green-foliaged trees discovered through symptoms of the strip killing of the bark, and these trees very often had heavy broods in the bark. Spotting in the Sugar Pine took place so early that the characteristic fading of an overwintering brood-bearing tree had not yet developed to any extent, which accounts for the high percentage of green-foliaged trees in the Sugar Pine found infested. Less than 50 per cent of the treated Sugar Pine had any direct evidence in the lower portions of the boles that a brood existed. Spotting under these conditions was very trying, especially for those spotters brought in from Northern California and Oregon where conditions are altogether different entomologically.

The spotting records and the maps were kept by the compassman, who assigned tree numbers to the spotters in consecutive order as each tree was marked for treating. The spotters tagged the tree with the tree tags standardized by the Bureau of Entomology, filling out the data called for on the tags and inserting them, folded up in quarters, in slits hacked in the bark. Care was taken in making these slits so that flowing pitch would not get on the tags. The tree was blazed on at least two sides so that it could be seen from a reasonable distance by the camp foreman. Each tree was marked with the number provided for it so that in case the tag was lost a record remained that could be checked back on the spotting records. Incidentally, some of these tree tags were chewed up by squirrels.

Spotting Costs and Man-Days Spotting

	Costs			Man-Days		
Camp	Head Spotter	Spotters	Compassman	Head Spotter	Spotters	Compassman
A	$310.00	$ 532.00	$ 418.00	62	119½	88
B	180.00	256.50	171.00	36	57	36
C	125.00	171.00	118.75	25	37	25
D	97.50	166.50	92.63	19½	37	19½
E	85.00	175.50	142.50	17	39	30
F			9.50 (Foreman did own spotting)			2
GCBO	10.00	71.50	4.75	2	16	1
GCWR		31.50	47.50		7½	10
H	22.50	76.50	71.25	4½	17	15
YV	45.00			9		
	$875.00	$1,481.00	$1,075.88	175	330	226½
Totals			$3,431.88			731½

Spotting Costs and Man-Days Spotting
(Continued)

Trees spotted per man-day	4.95
Board feet spotted per man-day	16,025.00
Acres spotted per man-day	70.00
Cost per tree spotted	$0.9⅓1
Cost per thousand feet spotted	$0.29

Methods of Treating

Treating was carried on in all sorts of weather with very favorable and very unfavorable burning conditions. The control program was launched before actual winter conditions disappeared on the greater portion of the areas covered in the units. Treating methods varied with conditions on the ground, and in some cases the trees were treated on snow four and five feet in depth where the construction of fire trenches would be too costly and illogical. In most cases of burning in the snow, the treatment was highly successful, but where the snow was not so deep some damage was done in fires escaping after the snow had been melted away by the fires and the duff reached by the flames. These duff fires burned under the snow for some time after the destruction of the brood, and formed one of the objectionable features of the insect control work. It was one of the lessons learned that treating in the snow had to be closely watched to insure the complete destruction of the brood and prevent the escape of the duff fires. As the season advanced, trenches were constructed as conditions warranted, until toward the end of the program ideally constructed trenches were the rule. All insect infested bark except the portion underneath the log next to the ground was peeled and banked against the log to burn the under portion left unpeeled. When burning in the snow, additional fuel was piled on in the form of the limbs, and a very hot fire was thus obtained that completely burned up the log in some cases. This practice of piling on the limbs became less and less so with the advancing season, until only the peeled bark was banked against the log.

Only the bark containing an infestation was burned; the abandoned bark was left on the tree. Uninfested green bark was peeled and left to dry out on the ground. It was considered good entomological practice to leave the abandoned bark on the logs so that predators could develop and, also, so that the costs of effective treating could be reduced. It was also the practice of the fallers to throw the trees away from the stump whenever possible. This was for the purpose of eliminating hangover fires in the stumps and protecting the predators hatching in the bark around the root collar, particularly the Clerids. Whenever trees had to be treated in sight of the highways, the stumps were cut flush with the ground unless physical conditions prevented it. Practices such as the low

cutting of stubps helped to step up the treating costs, but it is to be expected that there will be such additional cost on any insect control project in the National Parks.

It will be noted in the appended summary of treating that a number of logs are included in the treating. These logs are either trees found wind-falled or dropped for some reason or other. Some of these logs treated were decked logs at one of the local sawmills at Wawona, and were found to contain a moderate amount of infestation.

Tabulation of Treating by Each Camp

Crew	Species	No. of Trees	Total D.B.H. (In.)	Total Volume (Bd.Ft)	Average D.B.H. (In.)	Average Volume (Bd.Ft)	Logs No.	Logs Volume (Bd.Ft)
	P.P.	746	21,948	1,394,200	29.4	1,869	6	6,570
A	S.P.	415	19,498	2,204.870	47.0	5,313	45	51,330
	Total	1,161	41,446	3,599,070	35.7	3,100	53	57,900
	P.P.	426	12,656	819,770	29.7	1,924		
B	S.P.	301	13,929	1,798,870	46.3	5,976		
	Total	727	26,585	2,618,640	36.6	3,602		
	P.P.	374	9,072	314,860	24.3	842	3	1,380
C	S.P.	73	3,004	249,310	41.2	3,415		
	Total	447	12,076	564,170	27.0	1,262	3	1,380
	P.P.	225	6,268	317,820	27.9	1,413		
D	S.P.	204	10,376	1,120,340	50.9	5,492		
	Total	429	16,644	1,436,160	38.8	3,352		
	P.P.	157	4,528	275,310	28.8	1,754	6	3,910
E	S.P.	186	10,184	1,381,600	54.8	7,428	3	15,960
	Total	343	14,712	1,656,910	42.9	4,831	9	19,870
	P.P.	42	1,586	122,880	37.8	2,926		
F	S.P.	74	4,046	468,340	54.7	6,329		
	Total	116	5,634	591,220	48.6	5,097		
GC	P.P.	73	2,110	96,570	28.9	1,323		
Big Oak	S.P.	26	848	50,820	32.6	1,955		
Flat	Total	99	2,958	147,390	29.9	1,489		
GC	P.P.	105	2,348	78,820	22.4	751	5	10,230
Wawona	S.P.	45	1,668	143,910	37.1	3,198	7	34,510
Road	Total	150	4,016	222,730	26.8	1,485	12	44,740
	P.P.	8	284	25,500	35.5	3,188		
H	S.P.	79	3,952	555,990	50.0	7,038	2	4,480
	Total	87	4,236	581,490	48.7	6,684	2	4,480
	P.P.	39	874	36,410	22.4	934		
YY	S.P.	1	70	12,770	70.0	12,770		
	Total	40	944	49,180	23.6	1,230		
	P.P.	2,195	61,676	3,482,140	28.1	1,586	22	22,090
Grand)	S.P.	1,404	67,575	7,986,820	48.1	5,689	57	106,280
Total)--		3,599	129,251	11,468,960	35.9	3,187	79	128,370

Total Bark Surface Treated
and Number of Insects in Larval Stages Destroyed

	Ponderosa Pine	Sugar Pine	Windfalls and Logs	Total
Number of Trees	2,915	1,404	79	3,678
Average D.B.H.	28 in.	48 in.		
Average Height	120 ft.	170 ft.		
Total Bark Surface (In sq. ft.)	1,007,505	1,564,056	44,676	2,616,237
Number of Insects in Brood	201,501,000	312,811,200	8,925,200	523,237,400

Conclusions and Recommendations

Although the per acre loss is small, the insect infestation situation is serious from the Park Service viewpoint. For the Park to lose eleven and one-half million feet of some of the finest timber in the world in one beetle generation is very serious, and anything that can be done to prevent a repetition of the loss is not too much. Some of the attached photographs will give a fine idea of the kind and size of the trees lost to the depredations of the bark beetles. Without a doubt the losses from the ravages of these bark beetles will be considerably less for at least the next two insect generations, due to the great reduction in the numbers of the beetles that would have emerged this spring had not the spring insect control taken place. To expect the fullest benefit from insect control operations without control on a like scale on the infested areas adjacent to the Park is asking too much. The insect population on the adjoining lands must be reduced in the near future to safeguard the large sums already spent on Park lands in the last two years on insect control work. Cooperation of a tangible nature on these adjoining lands is the goal that the Park should strive for within the following six months.

Taking into consideration all the factors present this spring, the insect control program functioned extremely well and, as stated before, there will be a great decrease in the amount of timber lost to the beetles. The men enrolled for the work were with very few exceptions men that had made the logging game their means of livelihood. It was very fortunate for the Park that it was able to obtain enough very good logging foremen who proceeded with the work without any loss of time. The general foreman paid for himself many times over in coordinating the erection of the camps as they were needed and the transportation of the men.

With the exception of the Forest Service lands, it was found that the heaviest infestation occurred on lands within and immediately adjacent to areas burned over in the last two years. The heqviest concentration existed in Section 27, Township 4 South, Range 21 East, near Wawona, where the largest fire in the recent history of the Park occurred in July, 1931. The next heaviest concentration occurred on the Coulterville Road where two fires in two successive years have burned over practically the same area. It is to be expected, then, that fires will attract the beetles and that we will find our heaviest concentrations near or in these areas.

It is recommended that the future control projects proceed in essentially the same manner, as it was found that the organization which was developed satisfied the conditions very well. Some minor corrections will, however, be made where necessary. One thing should be borne in mind; and that is the spotters should be given a little more time in advance of the treaters at the beginning of the control project. A week will be sufficient under the amount of infestation found in the spring control project. It takes time to learn the brood conditions and the country in which the control is taking place. Placing the spotting or technical side of the program in one hand and the treating side in another worked extremely well. The specialization of each branch of the work by the heads of that branch insured the maximum of results in the whole program. It is recommended that the procedure for responsibility in the future control projects be exactly in line with that carried out this spring.

It is recommended that summer control maintenance be carried on to the fullest extent possible with the labor available from the Emergency Conservation Work camps allotted to the Park. This maintenance work can be done by the sun-curing method of treating, and good results can be expected in keeping down the brood trees that escaped the spring control and that develop from reinfestation from areas outside of the Park.

APPENDIX

Tables of Costs,

Amounts of Work Performed,

Etc.

Man-Days of Treating

Camp	Foreman	Axeman	Laborer	Saw Filer
A	68	1,220-3/4	13-1/2	
B	41	785	0	
C	21	347-1/2	7-1/2	
D	25	582-1/2	6	
E	23	448-1/2	1	
F	22-1/2	146	0	
GCBO	27	158	1	
GCWR	4	121	0	
H	6	155-1/2	0	
YV	9-1/2	36	0	
	34 (General Foreman			123
Totals	281	4,000-3/4	29	123
	$1,645.50	$18,003.37	$116.00	$615.00

Grand Total 4,433-3/4

Number of Trees treated per man-day 0.81

Volume Treated per man-day .... 2,636.00 board feet

Man-Days in Transportation and Protection

Camp	Truck Driver	Packer	Horses	Fireguard
A	79-1/2			68
B	32-3/4			70
C	6-3/4			27
D	1-1/2			45
E	10-1/2			22
F	1-1/4	17	70	
GCBO	1			
GCWR	4			4
H				7
After control operations had ceased				19-1/2
Totals	137-1/4	17	70	265-1/2

Grand Total 489-3/4

Man-Days on Camp Construction

Camp	Foreman	Axeman	Laborer	Truck Driver	Bull Cook
A. E. Wood		40	21	34	61
Big Meadows	4	53	20	15-1/2	33
Ackerson Mds.		52	20	25	31
Aspen Valley		49-1/2	19-1/4	30	18
Crane Flat		28	4-1/2	9	7
	34 (General Foreman)				
Total	38	222-1/2	84-3/4	113-1/2	150
				Grand Total	608-3/4

Man-Days on Camp Construction 608-3/4

Camp A. E. Wood had the following additional man-days:

Packer	11	
Electrician	2	
Plumber	4-3/4	
Truck Driver	2-7/8	
Harness Maker	1/4	
Truck Driver	3	
Compassman	1	
Sub-Foreman	7	31-7/8

Camp at Big Meadows had the following:

Electrician	1-1/2	1-1/2

Camp at Ackerson Meadows had the following:

Plumber	1/4	
Truck Driver	3	
Mechanic	1/4	
Head Spotter	1-1/2	
Spotter	1-1/2	
Compassman	1-1/2	8

Camp at Aspen Valley had the following:

Mechanic	1/2	1/2

Camp at Crane Flat had no additional man-days

TOTAL ADDITIONAL MAN-DAYS 41-7/8

TOTAL MAN-DAYS (Camp Constr).. 650-5/8

Summary of Man-Days

Total man-days of paid labor	6,305-5/8
Total man-days contributed labor	80
Grand Total man-days labor	6,385-5/8

The 80 man-days of contributed labor represent the labor of the Ranger-Forester, the only source of this type of labor.

Summary of Actual Expenses by Job Numbers

Job No.	Wages	Supplies	Trans. & Handling	Trucks	Communi-cation	Corral Opera.	Print'g	Totals
826.5	$ 1,216.17	$ 518.69	$ 62.25	$ 68.13	$	$	$	$1,865.24
826.6	5,979.68	130.28	15.62	229.44	.15			6,355.17
826.7	4,918.19	26.56		83.13	3.18			5,031.06
826.8	4,122.72	39.53	4.74	85.25				4,252.24
826.9	522.59	83.93	10.07	48.06	(Trans.- 826.10)		165.85	830.50
826.11	520.59	78.54	9.43	45.56	(Trans.)		15.75	669.87
826.12	3,289.36	24.32	2.92	12.56				3,329.16
826.13	526.40	19.64	2.36	9.00	29.23		20.91	607.54
826.14	2,491.16	1.82	.22	24.62				2,517.82
826.15	846.94	2.75	.33	2.81		70.00		922.83
826.16	504.49	101.94	12.23	58.56				677.22
826.17	203.10	3.55	.43	10.50				217.58
826.18	824.84			8.00				832.84
826.19	216.32	.10	.01	12.00				228.43
Totals	$26,182.55	$1,031.65	$120.61	$697.62	$32.56	$70.00	$20.91 $181.60	$28,337.50

Explanation of Job Numbers

826.5 Setting up and running expense of Camp A. E. Wood at Wawona.
826.6 Operation expenses of the A crew in the Wawona Basin unit.
826.7 Operation expenses of the B crew along the Wawona Road unit.
826.8 Operation expenses of the C crew in the Big Meadows and Wawona Road units.
826.9 Setting up and running expenses of the camp at Big Meadows.
826.11 Setting up and running expenses of the camp at Ackerson Meadows.
826.12 Operation expenses of the D crew at Ackerson Meadows.
826.13 General expenses, such as telephone, telegraph, and miscellaneous supplies.
826.14 Operation expenses in the Aspen Valley-South Fork sub-unit, E crew.
826.15 Setting up and operation expenses of the Chilnualna Creek camp, F crew.
826.16 Setting up and running expenses of the camp at Aspen Valley.
826.17 Setting up and running expenses of the camp at Crane Flat.
826.18 Operation expenses of the H crew at Crane Flat.
826.19 Operation expenses of the YV crew in Yosemite Valley

Items such as gasoline for lighting purposes, kerosene, firewood, lumber, and pipe are included in the lists of supplies. The cost of gasoline and oil is absorbed in the rental fee for the trucks used on the projects.

Tabulation of the Total Amount of Work Done

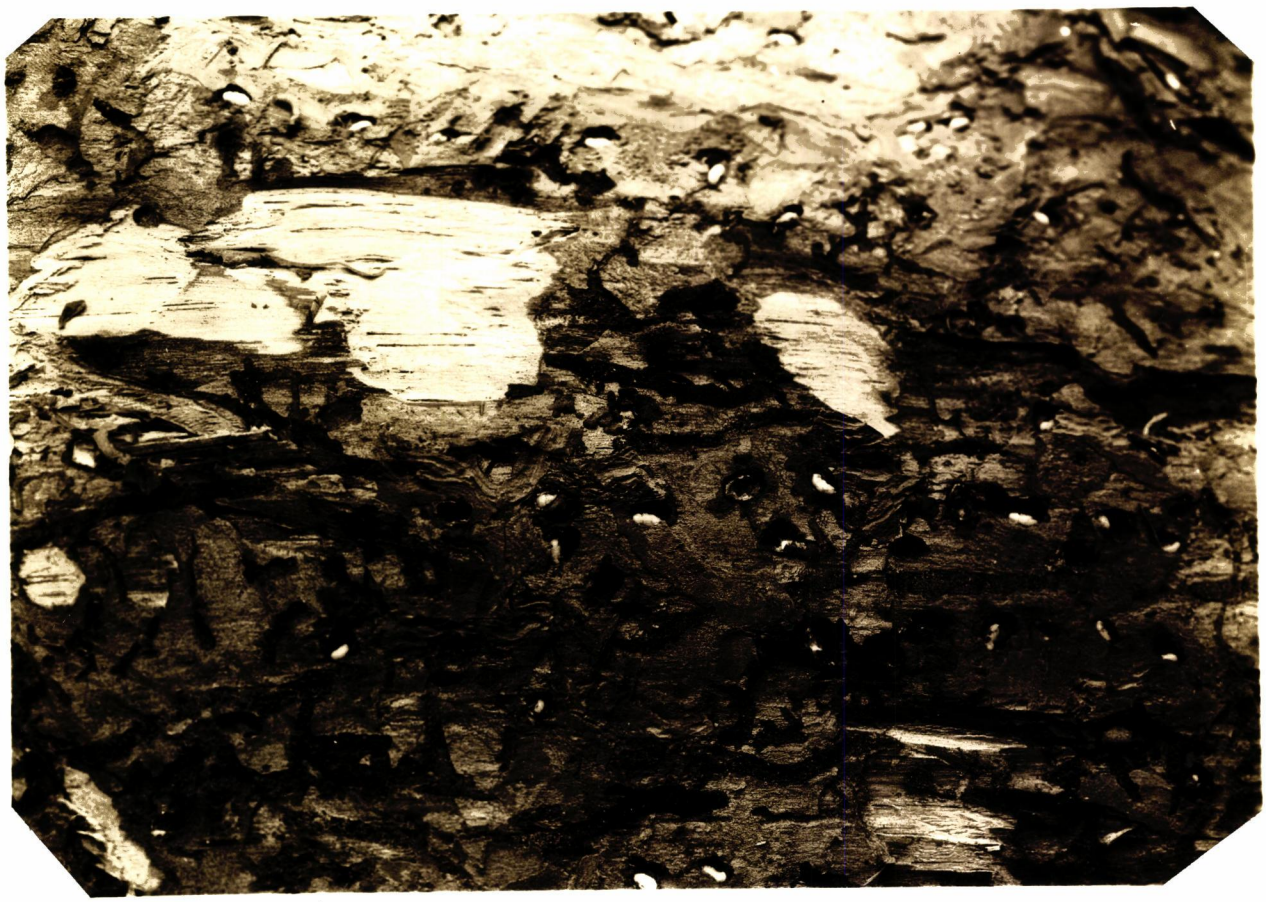
	Ponderosa Pine	Sugar Pine	Total	Logs
Number of Trees Spotted			3,645	
Number of Trees Treated	2,195	1,404	3,599	79
Volume of Trees Treated (Bd.Ft)	3,482,140	7,986,820	11,468,960	125,370
Bark Surface Treated (Bd.Ft)	1,007,505	1,564,056	2,616,237	44,676
Number of Larvae Destroyed	201,501,000	312,811,200	523,237,400	8,925,200

Acreage Treated	48,909
Acreage Protected	60,000
Average Number of Trees per Acre	.074 (per Section, 47-1/2)
Average Diameter	35.9 in.
Average Volume	3,187.0 bd. ft.
Loss in Board Feet per Acre	234.4 bd. ft.

Tabulation of Average Costs

Cost per Tree Treated, treating costs only	$ 5.66
Cost per Tree Treated, all costs	$ 8.04
Cost per Thousand Feet Treated, treating costs only	$ 1.75
Cost per Thousand Feet Treated, all costs	$ 2.62
Cost per Acre Treated, treating costs only	$ 0.417
Cost per Acre Treated, all costs	$ 0.621
Cost per Acre Protected, treating costs only	$ 0.339
Cost per Acre Protected, all costs	$ 0.506
Cost per Man-day of Treating Labor	$ 4.82
Cost per Man-day of all labor	$ 4.547
Cost per Tree Spotted, spotting costs only	$ 0.941
Cost per Thousand Feet Spotted, spotting costs only	$ 0.29
Number of Trees Treated per Man-day of Treating Labor	0.81
Volume Treated per Man-day of Treating Labor	2,638.00 bd.ft.

The largest tree cut because of insect infestation, 117 inches in diameter at 4 and ½ feet from the ground. Compare its tremendous size with the men at its base. Indications of the attack are barely noticeable in the leaves. This tree had a very large brood thruout its entire length.



Pupae of the Mountain Pine Beetle in the bark of a beautiful large Sugar Pine in the Wawona Basin. This photograph covers an area not over a foot in length and indicates what a normally infested tree harbors in its bark. The white forms are th pupae in their pupal cells.

The indicative fade of a heavily infested Sugar Pine tree in the Mariposa Grove of Big Trees on the main road thru the Grove just below and in s ight of the Grizzly Giant.

Making the undercut on the 117 inch Sugar Pine. Note the burnt out heart of the butt and the springboarding necessary to reach the undercut level.

Indicative of some of the conditions and sizes of trees found infested in the Park.This is the largest tree cut 117 inches at breast height. High stump because of Flared and burnt out butt. Note the spring boarding necessary to reach good sawing level.

Peeling the infested bark from the tree. This is part of the work on the 117 inch tree. Note the discoloration of the sap from the infestation in the bark.

Peeling the top of a big log quite a little job in itself. Logs are peeled at least two thirds d own the sides so that the accumulated bark will be enough to completly destroy the remaining bark. Bark still green was also peeled and allowed to dry out.

Peeling the bark from a Sugar Pine infested by the Mountain Pine Beetle. Note how low the bark is peeled. The bark is banked against the log and the hot fire from the banked bark destroys the insects in the bark that can not be reached.

A good example of treating in the snow. A 92 inch Sugar Pine felled and treated in the Wawona Basin early in the season. Note the narrow fire belt and the minimum of damage to the surrounding vegetation although a hot fire was used to destroy the brood found in this tree. Compare the size of the tree to the man standing beside it.

Burning in the snow. Hot fires can be obtained in the snow by piling on the limbs and debris from the tree insuring the killing of the insects in the bark. It is from trees burned under the se conditions that fires later get away in hot weather because no trenches are built and the fire keeps burning in out of the way places undetected.

A typical treated tree with all of the infested bark treated. This tree was treated in the snow and shows the lack of damage to the surrounding vegetation when treating is done in the snow.

The follow up after treating. The fireguard putting out the fire after the burning of the insect infested bark. A necessary safeguard because of bad fire hazards in the beautiful Pon derosa and Sugar Pine timber.

Falling a large Ponderosa Pine in one of the camp grounds in Yosemite Valley. Note how low the stumps are cut in areas of intensive use. Later these stumps are further cut off flush with the ground in many instances.

A g ood job of falling and treating. Seven trees all laid the same way for treating. A good example of the way the infestation sometimes takes out groups of apparently healthy trees. Note, the way the bark at the root collar is left intact so that the predators can propagate.

Making the trench for fire protective purposes around a tree being treated. Note how the fire is burning beneath the log where it is impossible to peel the bark. The greatest part of the beetles in the unpeeled portions of the logs treated are destroyed in this manner.

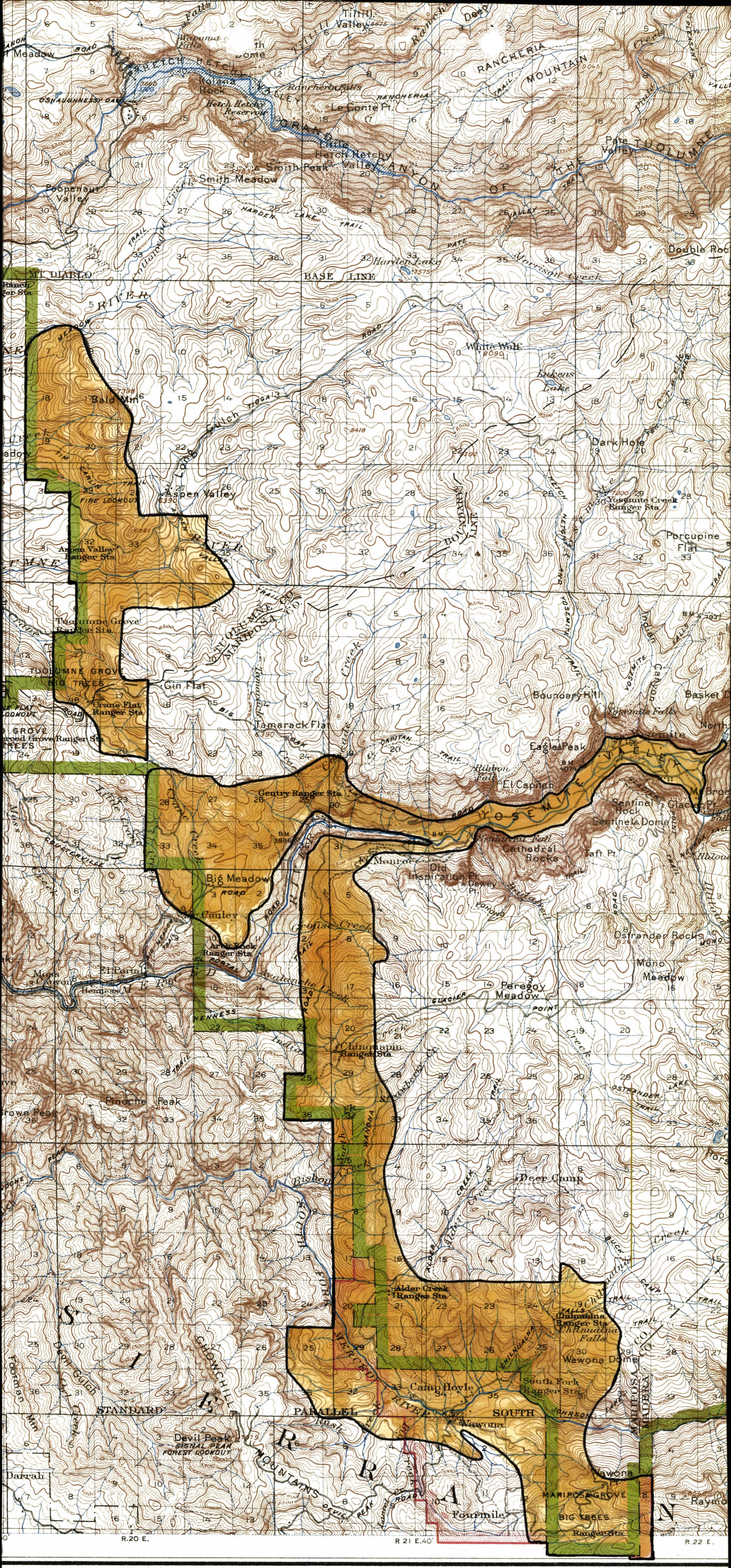
The insect control camp at Crane Flat constructed in 18 inches of snow. This camp is typical of those constructed also at Big Meadows, Ackerson Meadows and Aspen Valley Ranger Station.

Indicative of some of the difficulties encountered. The fallers crossing the South Fork of the Merced River on a log to reach the Forest Service lands in the Rush Creek basin. Note the ice formed on the branches and leaves on the down materials.

Foreman and spotters working up the daily data each evening in camp. A detailed system of keeping books accounted for a considerable amount of the foreman's and the spotters time each evening.

Cascadel Basin in the Sierra National Forest about 50 miles south of Yosemite. This represents the early stages of an epidemic a condition that has yet not been reached in Yosemite and which the spring control work will avert. All trees showing white are either fading or sorrel in color and are dying or recently killed. This photo was taken in 1931 and indicates what will happen in Yosemite if control work is not maintained.

Another example of what Yosemite is trying to avert. Recently killed Ponderosa Pine on the Blue Canyon area on the Sierra National Forest where 60% of the timber has lately been killed by bark beetles of the genus Dendroctonus.



Areas shaded in orange those on which treating of infested trees took place.

Areas treated represent the greater part of the Ponderosa and Sugar Pine in the Park.

Blue Prints

Showing Infestation Concentration

By Sections Only

T. 4. S.

T. 4. S.

R. 21 E.

R. 22 E.

INFESTATION CONCENTRATION

YOSEMITE NATIONAL PARK
INSECT CONTROL MAP
WAWONA AREA
MAR 1943

LEGEND

- Sugar Pine
- Ponderosa Pine

T. 3 S.

T. 4 S.

R. 20 E.

R. 21 E.

N

INFESTATION CONCENTRATION

YOSEMITE NATIONAL PARK
INSECT CONTROL MAP
CHINQUAPIN AREA
MAR 1933